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ABSTRACT

Previous studies within traditional university settings indicate that a student's mathematics anxiety is directly correlated to previous school mathematics performance, as well as the attitudes developed during those prior mathematics classroom experiences. As a consequence, special programs have been devised at local levels to help students cope more effectively with mathematics anxiety, particularly in nontraditional universities serving minority students, since these students matriculate with relatively low levels of skill in mathematics and presumably high levels of apprehension. This study is an attempt to determine whether previous research findings concerning mathematics anxiety are directly generalizable to the nontraditional university settings. At an open admissions urban university, the students comprising all six sections (n=106) of an introductory mathematics survey course were administered questionnaires about their previous mathematics experience and their attitudes about current mathematics involvement. Further, the students were supplied with a form of the Mathematics Anxiety Scale (Fennema and Sherman, 1976), as modified for applicability to college students. Among the results, positive attitudes toward mathematics were inversely related to mathematics anxiety, which is similar to previous findings. The number of mathematics courses taken in high school, however, was positively related to mathematics anxiety, which is contrary to previous research findings. (19 references) (JJK)

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Mathematics Anxiety: A Study of Minority Students in an Open Admissions Setting

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ABSTRACT

The study extended previous research findings concerning math anxiety obtained in traditional universities to an open admissions university with a predominately minority enrollment. One hundred six students were given the Fennema-Sherman Math Anxiety Scale and a questionnaire which assessed previous experiences in mathematics and attitudes toward mathematics. Similar to previous studies, positive attitudes toward mathematics were inversely related to math anxiety. However, contrary to previous studies, which have reported an inverse relation between high school preparation in mathematics and math anxiety, we found that the number of math courses taken in high school was positively related to math anxiety. Math anxiety was unrelated to final examination grades. Implications of these findings for math anxiety programs in open admissions universities were considered.

Math anxiety is a concept which has received considerable attention from both psychologists and math educators. Research has suggested that math anxiety is a variable which has a negative relationship with important measures of classroom behaviors in mathematics. Hauge and Robbins (1981) reported a significant negative relationship between math anxiety and class attendance. Brush (1978), Rosamilha, Cariola, Sipavicius, and Cifu (1981) found that math anxiety was positively correlated with dislike of math. Richardson and Suinn (1972), Betz (1977), and Hendel (1980) found that math anxiety was negatively correlated with performance on math tests. In addition to the above correlations, math anxiety has been related to a number of background measures such as number of math courses taken in high school and grades in high school math (Betz, 1977; Brush, 1978; and Hendel, 1980).

Because of the implications that math anxiety has for student performance, programs have been set up to reduce math anxiety. Such attempts at intervention have included cue-controlled relaxation and study-skills counseling (Bandel, Russell, and Zamostay, 1982), cognitive behavior modification (de Bronac-Meade, 1980; Deitch, 1981; and Nauheim, 1981), desensitization (Goodall, 1981; Trent and Fournet, 1987); and tutoring (Genshaft, 1982).

Almost all of the research on math anxiety in college students has been carried out in traditional colleges and universities in which the majority of the students are White and tend to come from middle and upper middle class backgrounds. One wonders whether the

relations observed between math anxiety and classroom performance and between math anxiety and prior experience with math would also hold with students coming from less educationally advantaged backgrounds. We were particularly interested in minority students attending nontraditional open admissions colleges and universities. Many of these students enter college with relatively low skill levels in mathematics. Scores on standardized placement tests developed by The College Entrance Examination Board and administered to incoming freshmen at the open admissions university where the current research was conducted indicated that a large majority of the students required remedial training in mathematics.

Because minority students entering open admissions universities are frequently not well prepared in mathematics, one might anticipate that many of these students would have significant problems with math anxiety. This possibility is suggested by previous research (Betz, 1977; Richardson and Woolfolk, 1980) which indicated that math anxiety is more likely to occur in students who have not had extensive coursework in math and that high school students in the upper half of the achievement distribution report more positive attitudes toward math than those in the lower half (Sherman and Fennema, 1977).

To date, there has been little direct research on math anxiety in minority students in open admissions colleges and universities. One study (Hauge and Robbins, 1981) which used a relatively brief questionnaire to assess the presence of math anxiety among students at an open admissions urban university suggested that math anxiety was a problem, but not for the majority of the students.

The present study was carried out to more systematically study math anxiety among minority students in an open admissions university. The purpose of the study was to extend the generalizability of research previously conducted in traditional universities. In doing this, we examined the relation of math anxiety to the students' previous experiences in mathematics, to their attitudes toward mathematics and to their current performance on mathematics tests.

Procedure

The study was carried out at an open admissions urban university, The University of the District of Columbia. In the University, there is no screening for admission using SAT scores or rank in high school graduating class. The current enrollment at the University is predominately African-American with some representation of Hispanic and Asian Americans, non Hispanic Whites and foreign nationals. The subjects in the study (N = 106) were all of the students (33 males, 73 females) enrolled in six sections of "college mathematics," a freshmen-level survey course designed for non-mathematics majors to meet the University's basic education requirement in mathematics. The prerequisite for this course is the successful completion of both arithmetic and basic algebra, either by receiving sufficiently high scores on the arithmetic and algebra tests developed by The College Entrance Examination Board or by enrolling in and passing the arithmetic and basic algebra courses offered by the University.

The design of the study was as follows. First a question-

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naire was given out to assess the students' previous experience in mathematics, their feelings about taking mathematics, their willingness to engage in projects involving the use of mathematics, and the amounts of time they were willing to spend studying for the course they were taking. The questions dealing with previous experience in mathematics asked about the number of courses in math the students had taken in both high school and at the University and how their grades in math compared with their grades in other courses. The questions concerning feelings about taking mathematics used a ten-item checklist in which students were asked to respond "Yes" or "No" to statements such as "Math is a boring subject" and "I look forward to taking math." The questions asking about willingness to work on projects involving the use of mathematics included such items as "Would you like to write a paper about applications of math in your major?" and Would you be interested in forming study groups to do advanced study?"

Following the questionnaire, the students were given a form of the Mathematics Anxiety Scale (Fennema and Sherman, 1976), which had been slightly reworded by Betz (1977) to make it appropriate for college students. The Scale is intended to assess feelings of anxiety, nervousness, and associated somatic symptoms related to doing math. The Anxiety Scale, which consists of ten items, employs a 5-point Likert-type scale, with higher scores indicating less math anxiety.

Results

In preliminary analyses, we compared the men and women in our

sample on The Fennema-Sherman Math Anxiety Scale and found that the difference was not significant. We also compared the math anxiety scores with the scores reported by Betz for three samples of students she studied at Ohio State. These samples were a remedial math class, an introductory psychology class, and a relatively advanced math class of students majoring in such fields as engineering, mathematics, physical science and pre-medicine. Despite the differences in time (Betz's paper was presented in 1977) and differences in the characteristics of the samples, it is interesting that for each of the three comparisons made, mean math anxiety levels for our sample were not significantly different from those of the Ohio State students.

(Table 1 about here)

Relationship of Math Anxiety to Previous Experiences in Mathematics

The number of math courses the students had taken in high school was positively correlated with the levels of math anxiety which they reported ($r = .36$, $p < .01$). However, the correlation of the number of math courses taken previously in college by the students with the Math Anxiety Scale was not significant.

We then considered the students' previous performance in math relative to other subjects. The students were divided into three groups based on their answers to the following question:

"Are your grades in math usually

( ) Better than your grades in other courses
( ) About the same as your grades in other courses
( ) Worse than your grades in other courses?"

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An analysis of variance showed the math anxiety scores of the three groups to be different $F(2,100) = 16.68$, $p < .001$. Reports of better grades in math relative to other subjects was associated with less math anxiety.

(Table 2 about here)

Attitudinal Correlates of Math Anxiety

Table 3 presents point biserial correlations between the students' responses to the ten items on the checklist concerning feelings about taking mathematics and the levels of math anxiety reported.

(Table 3 about here)

Significant relationships were found for seven of the ten attitudinal statements sampled and math anxiety scores. The students who perceived mathematics as difficult, had previous trouble with the subject, and felt poorly prepared to take it tended to have higher math anxiety scores. The students who perceived math more positively-- who looked forward to taking it, and felt they had done well in it before tended to have lower math anxiety scores. Math anxiety was also positively correlated with another kind of emotional reaction, one suggestive of dysphoric affect; the students indicated they were depressed at the thought of math.

Relation of Math Anxiety and Planned Study Time in College Mathematics

On our checklist of feelings relating to mathematics, we used the item, "If you work hard in math, you will do well." While almost all of the students responded "Yes" to the question, when we asked them "How much time would you be willing to spend preparing homework for a three-hour course in college math during the week,"

the mean response was two hours. A few of the students replied with "half an hour." We found no relation between this subjective estimate and scores on the Fennema-Sherman Math Anxiety Scale. Nor was there any relation between math anxiety and the students' stated willingness to work on projects or doing advanced study related to mathematics.

Correlation of Math Anxiety with Performance on the Final Examination Given in College Mathematics

The correlation between math anxiety and the students' scores on the departmental final exam given in college mathematics was .15, which was not significant.

Discussion

Studies carried out in traditional universities and colleges indicate that anxiety about mathematics relates to grades attained in mathematics. Such studies have also suggested that a student's experience in mathematics and attitudes toward mathematics relate to math anxiety levels. These findings were considered sufficiently important that special programs have been devised to help students cope more effectively with math anxiety.

Such special programs would appear to be particularly useful in nontraditional universities serving minority students, as many of these students enter the universities with relatively low levels of skill in mathematics and might be presumed to have considerable apprehension about the subject. However, our knowledge base about math anxiety in these schools is limited and it seemed appropriate to obtain more information before recommending programs. The present

study was undertaken to fill this need. We attempted to find out whether the research findings that have been reported in the literature were generalizable to nontraditional settings.

Within the limitations of the study--we collected data within a single metropolitan university and relied extensively on self-report measures, it appears that the pattern of relationships we uncovered relating to math anxiety was similar in some respects to earlier reports from more traditional universities, but there were some important differences. Let us first consider the similarities.

The level of math anxiety in our sample of minority students was about the same as that of students at Ohio State in spite of considerable differences in the dates at which the Fennema-Sherman Scale was administered and in the characteristics of the samples.

When we consider attitudes toward mathematics, the findings also seem similar. Brush (1978) reported that math anxiety was highly correlated with dislike for math. We used a sample of attitudinal statements and found a negative correlation between "Look forward to taking it" and math anxiety and a positive correlation between "depressed at the thought of it" and math anxiety. This latter finding seems particularly interesting, because it suggests that math anxiety may include a demoralizing component. In the psychological literature, anxiety and depressed affect tend to be positively correlated (Robbins, in press).

When we considered the relation of previous experience with mathematics and math anxiety scores, we found a different picture from what previous investigators have reported. Betz(1977), Brush(1978), and Hendel(1980) reported an inverse relation beetween high school

math courses taken and current level of math anxiety. We found a positive relation between the number of courses the students had taken in mathematics in high school and math anxiety.

One might assume that successful completion of high school mathematics would build confidence in one's math skills and hence would tend to reduce math anxiety. This would offer a rationale for the previous findings of inverse relationships. We can only raise the question as to what happened in the experiences of our minority-open admissions students to turn this relationship around. This is a question which calls for additional research.

How well the students did in prior math classes seems to predict math anxiety levels better than simply tallying up the number of courses previously taken. Students who reported that their grades in math were better than in other subjects had the lowest level of of math anxiety, while students who reported that their grades in math were worse than in other subjects had the highest level of math anxiety. This differential experience seems to be reflected in differential mind sets in approaching mathematics. We found that students who reported that they felt poorly prepared to take math and found it very difficult had higher levels of math anxiety. In contrast the students who had always done well in the subject had lower levels of math anxiety.

The nonsignificant correlation between math anxiety and the students' grades on the departmental final exam stands in contrast to earlier reports of Richardson and Suinn (1972), Betz (1977), and Hendel (1980) that math anxiety was negatively related to test scores in mathematics. It should be noted, however, that not all studies

carried out in traditional universities have found that math anxiety predicted student grades on mathematics tests (Llabre and Suarez, 1985; Hunsley, 1987). Our data suggest that among minority students attending an open admissions university, math anxiety may not be an important predictor of student classroom performance.

What implications do our findings have for programs to help students cope with math anxiety in open admissions settings? Our data relating grades in math courses relative to other subjects and math anxiety suggest that one might approach the problem of math anxiety indirectly by devising programs which provide success experiences in math. A carefully developed program of graduated difficulty with built in success experiences might well reduce math anxiety while at the same time build math skills. The focus would shift from an emphasis on diminishing math anxiety, per se, to building confidence through skill attainment. We would like to see such a program evaluated.

Finally, one of our incidental findings seems worthy of reiteration. We found that nearly all of the open admissions students answered "Yes" to the question, "If you work hard in math, you will do well." Yet when they were specifically asked how much time they would be willing to spend weekly studying for the three-hour course in college mathematics they were presently taking, the mean response was "two hours." A few students responded "half an hour." It seems important that for students to realize their potential in learning mathematics that they appreciate the need for scheduling an appropriate amount of study time for the subject.

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Table 1

Means on Math Anxiety Scale by Open Admissions Students and Ohio State University Students

Subject Group	N	$\bar{X}$	s
Open Admissions Students	106	31.5	9.4
Ohio State University Students:			
Remedial Math Class	125	26.9	7.6
Introductory Psychology Class	182	31.1	9.0
Relatively Advanced Math Class	348	31.6	8.7

* Means were obtained from a 10-item math anxiety scale. Higher scores indicate less math anxiety. Scores may range from 10 to 50.

Table 2

Point Biserial Correlations between Students' Responses to Items Asking about the Students' Perceptions of Taking Mathematics and Their Levels of Math Anxiety

	% Responding "Yes"	r with Math Anxiety
A subject I have always done well in	54%	-.51*
Boring subject	17%	.09
Depressed at the thought of it	24%	.43*
One of the most important subjects in school	74%	-.04
Feel poorly prepared to take it	18%	.30*
Look forward to taking it	67%	-.36*
Waste of time	3%	.00
Very difficult for me	32%	.42*
Never could do it before	14%	.22**
If you work hard, you will do well.	93%	.20**

* $p < .01$

** $p < .05$

In this table, scores for the Fennema-Sherman Scale were reversed. A positive correlation indicates a positive relationship to math anxiety.

Table 3

Means of Open Admissions Students' Scores on the Math Anxiety Scale as a Function of Their Previous Performance in Math versus Their Performance in Other Subjects

Students	N	$\bar{X}$	s
who had received better grades in math than in other courses	15	38.87	4.86
who had received about the same grades in other courses	65	32.54	8.05
who had received worse grades in math than in other courses	23	23.83	10.03

Means were obtained from a 10-item math anxiety scale. Higher scores indicate less math anxiety. Scores may range from 10 to 50.

References

Bandel, R., Russell, R., and Zamostay, K. (1982). A comparison of cue-controlled relaxation and study skills counseling in the treatment of math anxiety. Journal of Educational Psychology, 74, 96-103.

Betz, N. E. (1977). Math anxiety: what is it? (Paper presented at the Eighty-fifth Annual Convention of The American Psychological Association.

Brush, L. (1978). A validation study of the math anxiety rating scale (MARS). Educational and Psychological Measurement, 38, 485-490.

de Bronac-Meade, M. (1980). Reduction of math anxiety: a cognitive behavior modification approach. (Dissertation, California School of Professional Psychology).

Deitch, I. (1981). Cognitive-behavioral treatment of math anxiety in college women. (Dissertation, Yeshiva University).

Fennema, E. and Sherman, J. (1976). Fennema-Sherman mathematics attitude scales: instruments designed to measure attitudes toward the learning of mathematics by males and females. Catalog of Selected Documents in Psychology, 7, 36.

Genshaft, J. (1982). The use of cognitive behavior therapy for reducing math anxiety. School Psychology Review, 11, 32-34.

Goodall, C. (1980). The reduction of mathematics anxiety utilizing relaxation and desensitization and the presentation of practical examples. (Dissertation, University of South Florida).

Hauge, S. and Robbins, P. (1981). Orienting inner city students to college mathematics. School Science and Mathematics, 81, 115-140.

Hendel, D. (1980). Experiential and affective correlates of math anxiety in adult women. Psychology of Women Quarterly, 5, 219-230.

Hunsley, J. (1987). Cognitive processes in mathematics anxiety and test anxiety: the role of appraisals, internal dialogue, and attributions. Journal of Educational Psychology, 79, 388-392.

Llabre, M. and Suarez, E. (1985). Predicting math anxiety and course performance in college women and men. Journal of Counseling Psychology, 32, 283-287.

Nauheim, J. (1980). The relative efficacies of anxiety management training, negative practice, and cognitive therapy in the treatment of test anxiety. (Dissertation, Hofstra University).

Richardson, F. and Suinn, R. (1972). The mathematics anxiety rating scale: psychometric data. Journal of Counseling Psychology, 9, 551-554.

Richardson, F., and Woolfolk, R. D. (1980). Mathematics anxiety In I. G. Sarason (Ed.), Test Anxiety: Theory, Research, and Applications (pp. 271-288). Hillsdale, New Jersey: Erlbaum.

Robbins, P. (In press). Understanding Depression: Jefferson, North Carolina: McFarland.

Trent, R. and Fournet, G. (1987). The effects of hypnotherapeutic restructuring, systematic desensitization, and expectance control on mathematics anxiety, attitude, and performance in females and males. Educational and Psychological Research, 7, 137-150.

Rosamilha, N., Cariola, T., Sipavicius, N., Cifu, S. (1981). Anxiety and attitudes toward mathematics. Arquivos Brasilerios de Psicologia, 33, 57-63.

Suinn, R. and Edwards, R. (1982). The measurement of math anxiety: the mathematics anxiety rating scale for adolescents (MARS). Journal of Clinical Psychology, 576-580.